

AMENDMENTS TO THE DRAWINGS

In response to the drawing objection, a new drawing sheet (Figure 7) is submitted herewith. Fig. 7 is a schematic representation showing a general structure of an exemplary group III nitride light-emitting device including n-type layer 21, a p-type layer 23, light emitting layer 22, negative electrode 24, and positive electrode 27. The positive electrode 27 is composed of translucent electrode 25 and pad electrode 26. This drawing is submitted pursuant to 37 C.F.R. § 1.83 and the Examiner's request for a drawing which illustrates the above-noted features of the claimed invention. No new matter has been added.

Attachment: One new drawing sheet (Fig. 7)

REMARKS

Claims 1-17 are all the claims pending in the application. Claims 16-17 have been withdrawn from consideration.

I. Drawing Objection

Paragraph No. 5. The Examiner objected to the drawings to under 37 C.F.R. § 1.83(a) as not showing every feature of the invention specified in the claims.

In response to the drawing objection, a new drawing (Fig. 7) is submitted herewith to show the following features: (1) an n-type layer 21; (2) a p-type layer 23; (3) light emitting layer 22; (4) a negative electrode 24; and (5) a positive electrode 27. Fig. 7 also shows that the positive electrode 27 is composed of translucent electrode 25 and pad electrode 26, which is described in the present specification on page 19, line 32 to page 20, line 1.

No new matter has been added.

Withdrawal of the objection and acceptance of the new drawing sheet are respectfully requested.

II. Claim Rejections under 35 USC § 103 Based on Sunakawa

Paragraph No. 6. Claims 1, 2, 3, 5-10, 13-15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sunakawa et al. (US 2003/0207125; “Sunakawa”) in view of Ishida (US 6,864,158; “Ishida”).

Paragraph No. 7. Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sunakawa in view of Cuomo et al (US 2002/0078881; “Cuomo”).

Paragraph No. 8. Claims 11 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sunakawa in view of Uemura et al (US 6,917,059; “Uemura”).

Applicants respectfully traverse the above rejections.

Claim 1 recites a Group III nitride semiconductor multilayer structure comprising a substrate; an $\text{Al}_x\text{Ga}_{1-x}\text{N}$ ($0 \leq x \leq 1$) buffer layer which is provided on the substrate and has a columnar or island-like crystal structure; and an $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x + y \leq 1$) single-crystal layer provided on the buffer layer, wherein the substrate has, on its surface, non-periodically distributed grooves having an average depth of 0.01 to 5 μm .

The Examiner cited Figs. 1A-1F and Abstract of Sunakawa as disclosing all of the limitations of claim 1, except for the recitation of grooves (14) having the claimed average depth.

Specifically, the Examiner asserted that Sunakawa discloses a Group III nitride (e.g. Abstract) semiconductor multilayer structure (e.g. Figs. 1A-1F) comprising a substrate 11; an $\text{Al}_x\text{Ga}_{1-x}\text{N}$ ($0 \leq x \leq 1$) buffer layer 12 which is provided on the substrate 11 and has a columnar or island-like crystal structure (e.g. Fig. 1C, Paragraph [0107]); and an $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$ ($0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x + y \leq 1$) single-crystal layer 15 provided on the buffer layer 12, wherein the substrate 11 has, on its surface, non-periodically (e.g. Figs. 1C-1F show non-periodic grooves) distributed grooves 14. The Examiner contended that Sunakawa discloses at paragraph [0107] that groove 14 is formed during a phosphoric acid and sulfuric acid etch (1:1 volume ratio) of GaN layer 12 since the acid ratio also etches sapphire substrate 11.

Ishida was relied upon as teaching (in Fig. 1C, Col. 9, lines 51-57) that the sapphire substrate 11 was etched to form groove 14 having depth of 0.1 to 1 μm .

The Examiner considered that it would have been obvious to form the groove having an average depth of 0.01 to 5 μm through routine experimentation of the etching chemistry/parameters. The Examiner asserted that it is well known in the semiconductor fabrication process to optimize the etching thickness of any particular parameter within a

technology using design of experiment (DOE) technique to meet certain product specific performance and reliability.

Applicants respectfully disagree.

The average depth of the groove recited in claim 1 is not a mere matter of optimization under §103(a). Specifically, a particular parameter must be recognized as a result-effective variable, before the optimum ranges of the variable might be characterized as routine experimentation. See MPEP § 2144.05. In this regard, the Examiner has not established that the average depth of the groove is a result-effective parameter, as evidenced by Sunakawa's complete silence with regard to the average depth of the grooves.

Further, Ishida is not properly combinable with Sunakawa. In Ishida, the grooves 11a having a depth of 0.1 μm are formed by RIE (dry) etching, different from the wet etching employed by Sunakawa. The use of the dry etching technique of Ishida in place of the wet etching technique of Sunakawa would render Sunakawa unsuitable for its intended purpose.

Specifically, paragraph [0075] of Sunakawa describes that the buffer layer is generally formed of fine crystal gains, and that the insular crystal composed of the fine crystal gains is formed by wet etching. By wet etching, crystal gain boundaries are etched selectively and an isolated crystal gain portion is left.

On the other hand, in the dry etching disclosed in Ishida, because the whole buffer layer is etched uniformly, the whole buffer layer thins and an isolated portion is not formed.

In addition, of Sunakawa discloses at paragraph [0041] that since a striped pattern needs to be formed, a lithography process including dry etching must be carried out. Sunakawa discloses that in dry etching, when an etching mask pattern is not formed, a groove cannot be formed.

Accordingly, it is respectfully submitted that Sunakawa is not properly combinable with Ishida in the manner suggested by the Examiner.

Cuomo was cited as disclosing a buffer layer with columnar crystal grains.

Uemura was cited as disclosing a Group III nitride semiconductor light-emitting device comprising a Group III nitride semiconductor multilayer structure.

Cuomo and Uemura do not make up the noted deficiency of Sunakawa.

In view of the above, it is respectfully submitted that the claims 1-15 are patentable over Sunakawa in view of Ishida, Cuomo and/or Uemura, and withdrawal of the foregoing rejections under 35 U.S.C. §103(a) is respectfully requested.

III. Conclusion

Reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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